

Renal Physiology in Action:
Water / Salt Loading Experiment

Introduction

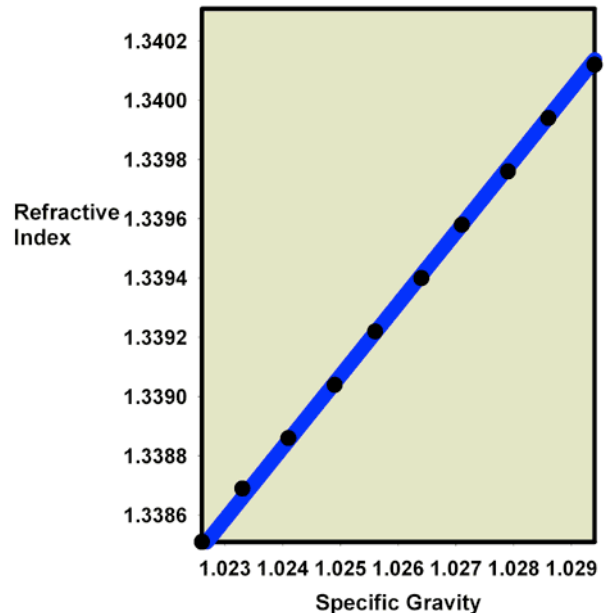
Today you will be assigned to a water-loading, salt-loading or control group for the next lab experiment. All students will be urinating every 20 minutes for 3 hours, so be prepared by wearing comfortable clothing! Please do not drink excessively before class, and try to avoid salt. Also do NOT use the restroom just before class, as you will need data at time '0'.

If you are in a water-loading group, be advised that we do NOT provide bottled water. Bring your own or drink from the tap. We will provide NaCl in the form of pretzels.

The question we want to address is, **how does the loading of water or salt affect urine volume and osmolarity (saltiness)?** You can probably make some predictions based on life experiences - what happens when you eat a bag of chips or drink a bottle of water? Remember that kidneys do not make water, they can only conserve it.

But how can you measure particles in solution? Well, there are a number of methods. The simplest involves a float - you take a float (usually some mercury in a glass ball) and float it in a column of fluid you want to measure. The principle is simple; the more solutes there are in a solution, the higher the float will float! (Think of yourself floating in the ocean versus a pool and you'll see the same phenomenon).

Another (and more accurate) way to measure particles in solution is to measure how those particles affect light waves. The index of refraction (or refractive index) is the ratio of the speed of light traveling through a vacuum to the speed of light in the material being tested. Light travels through most materials more slowly than it does through a vacuum, so their refractive index is higher than 1.00000. The detailed mathematics and physics behind refractive index are actually quite complicated, because it is often a complex number with real and imaginary parts, but a simple understanding is adequate: slower light travel leads to a higher refractive index, and there is a linear relationship between refractive index and specific gravity:



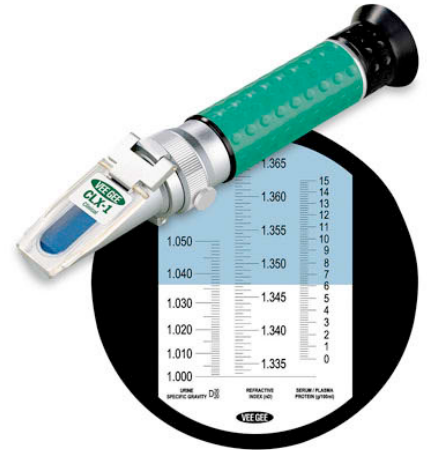
In this lab you will measure urine osmolarity with a refractometer - a device that has a prism and a scale inside. You place your sample on a glass window, look through an eyepiece and read the scale as the solutes in the solution refract (bend) light. When you look in our refractometers, you will see several scales depending on the model, such as:

1. Serum protein measured from 0 - 12.0 g / 100 ml
2. Refractive index scale measures from 1.333 - 1.360
3. Urine specific gravity scale measures from 1.000 - 1.060

LOOK at the BOOKLET that matches your model to see which scale to read at the horizon. Remember, the value you record must be between 1.000 and 1.060.

PROCEDURE: Set up your work area with paper towels!

1. BE ON TIME for this lab! Come in, take a collection cup and go collect your "Time 0" sample. When you return, cover your work area with a sheet of paper toweling to keep everything clean. **Your time '0' reading will be specific gravity only - the volume will not matter.** You will also use this urine to perform other tests as described in your lab manual or by the instructor.



GROUPS 2,3 and 4:

2. Load with the appropriate volume of water or salt as determined by your group assignment. Please try to drink you water or eat the pretzels as quickly as possible (5 minutes or so). Note the time when you finish drinking. While you are drinking, learn to use the refractometer (see below). **LOAD ONLY ONCE and load as QUICKLY as possible!**

During the remainder of the lab period, do NOT eat or drink anything else!

GROUP 1 (CONTROL)

2. You are going to be the envy of the class... but your data is extremely important! After collecting your Time 0 sample, you simply measure your urine volume and specific gravity every 20 minutes... BUT you are allowed to eat and drink as you normally would.

ALL GROUPS:

3. Determine osmolarity of your Time 0 sample using the refractometer. With a plastic transfer pipette, place 2 - 3 drops of urine on the prism and close the daylight plate.
4. Point the daylight plate in the direction of bright light and look into the eyepiece. Read the point of the urine specific gravity scale at which the boundary line crosses the scale. Record the number. REMEMBER, the range will be between 1.001 – 1.060.
5. With kimwipes and alcohol, clean and dry the prism for the next student.
6. Every 20 minutes after you finished loading, collect your urine. Measure the specific gravity and volume of each voided sample. (You may measure the volume in the bathroom, then bring a few drops back to class to measure osmolarity).
7. As your group collects data, average your results and write them on the board.
8. When you are finished, clean all supplies and wipe down your bench with disinfectant.

Personal Data

Your Group: _____

Sample	Specific Gravity	Urine Volume	Urine Production Rate
Time 0		XX	XX
20 min			
40 min			
60 min			
80 min			
100 min			
120 min			
140 min			
160 min			
180 min			

Total Urine Volume = _____

Divide the total urine volume by the volume of water consumed to get the percentage of water returned (control group members omit this calculation):

Percent Returned: _____

Urine production rate = ml / minute

Class Averages

Control Group

Sample	Specific Gravity	Urine Volume	Urine Production Rate
Time 0		XX	XX
20 min			
40 min			
60 min			
80 min			
100 min			
120 min			
140 min			
160 min			
180 min			

Class Data:

500 ml Water-Loaded Group

Sample	Specific Gravity	Urine Volume	Urine Production Rate
Time 0		XX	XX
20 min			
40 min			
60 min			
80 min			
100 min			
120 min			
140 min			
160 min			
180 min			

Class Data:
1000 ml Water-Loaded Group

Sample	Specific Gravity	Urine Volume	Urine Production Rate
Time 0		XX	XX
20 min			
40 min			
60 min			
80 min			
100 min			
120 min			
140 min			
160 min			
180 min			

Class Data:
Salt Group

Sample	Specific Gravity	Urine Volume	Urine Production Rate
Time 0		XX	XX
20 min			
40 min			
60 min			
80 min			
100 min			
120 min			
140 min			
160 min			
180 min			

In your lab notebook, make a graph of your personal data as well as the class data sets, using the format shown in the sample graphs in class.

In a paragraph, describe the results of this study and how they help to explain renal function. Answer additional questions supplied by your instructor.